ASPECTS OF ECOSYSTEM RECOVERY IN HUMAN-DOMINATED TROPICAL LANDSCAPE: CASE STUDY OF DEGRADED TROPICAL PEAT-SWAMP FOREST IN EX MEGA RICE PROJECT, CENTRAL KALIMANTAN, INDONESIA

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ABSTRACT

Knowledge on ecosystem recovery processes supports the efficacy of ecological restoration program like forest rehabilitation. However, in reality, ecosystems recovery process receives less attention in the design of ecological restoration program. Thus, based on literature review, case study in the rehabilitation of degraded peat swamp forest Ex Mega Rice Project in Central Kalimantan, Indonesia was reviewed to discuss the gap between current concepts of ecosystem recovery with the real conditions on the ground. Information collected through this study is useful for planning, implementing and monitoring the long term ecosystem recovery process of degraded tropical forest. From the analysis, this paper concluded that degree of degradation, ecosystem resiliency and ecosystem sensitivity are the major ecological aspects in ecosystem recovery. However, the dynamics of the degraded ecosystem determines the possibility of the ecosystem to be restored to its historical state. Moreover, maintaining long term ecosystem recovery process is challenged by time and costs, however community involvement may reduce the challenges. Making the restoration program as a local livelihood-oriented program may become one of the options to enhance the community participation. Hence, to improve the ecosystem services in the degraded ecosystems, both ecological and social aspects need to be addressed particularly in phase of determining the goals of the program.

INTRODUCTION

In a restoration program, prediction of ecosystem recovery processes can be used for determining the restoration goals. Generally, all ecological restoration projects share a common suite of ecological goals that consist of recovering ecosystem integrity, health, and the potential for long-term sustainability (SERI, 2005). However, determining such recovery state and processes is challenging in the ecosystem restoration (Kentula, 2000; Cortina *et al.*, 2006). Moreover, Guariguata and Ostertag (2000) depicted that the recovery of biophysical properties and vegetation is heavily dependent on the interactions between site-specific factors and landuse, which makes it extremely difficult to predict successional trajectories in anthropogenic settings.

Ex Mega Rice Project area is a river delta of 1.4 million hectares dominated by more than 900,000 ha of peat with roughly 450,000 ha being more than 3m deep (Government of Indonesia and Royal Netherlands Embassy, 2009). The area was degraded since it was opened for Mega Rice Project (MRP) initiated by the Indonesian government in 1995, with the purpose of aiming to converting forest into rice fields. Approximately 4,600 km of drainage and irrigation canals were constructed in an area of 1 million ha. However, the project failed and abandoned in 1999. The project has created enormous pressure on the local environment such as degradation of 1 million ha peatland. Nowadays, the degraded peatlands are used for agriculture, industrial plantations, and settlements or are left as wastelands.

In 2007, the Government of Indonesia launched a five-year program to rehabilitate and revitalize the 1.4 million hectares of degraded peat and lowland in the EMRP area. A master plan was then

developed based on study conducted and reported in Euroconsult Mott MacDonald (2008). Possible recovery process was discussed in the master plan.

Thus, based on literature review, case study on the rehabilitation initiative of degraded peat swamp forest Ex Mega Rice Project in Central Kalimantan, Indonesia was reviewed to discuss the gap between current concepts of ecosystem recovery with the real conditions on the ground. Information in this study is useful for planning, implementing and monitoring the long term ecosystem recovery process of degraded tropical forest.

Ecological Aspects in the Ecosystem Recovery Processes

Ecological restoration aims to initiate or facilitate the resumption of processes which will return the ecosystem to its intended trajectory through recovery paths (SER, 2005). In 1916, Frederick Clement proposed concept linear recovery path with a stable end-stage called the climax. However, Clement' climax concept is almost cannot be used to illustrate the ecosystem recovery path in human-dominated landscape. Thus, Suding *et al.* (2004) proposed alternative states and positive feedbacks in restoration ecology that explained the variation of ecological dynamics in degraded system (Fig 1.).

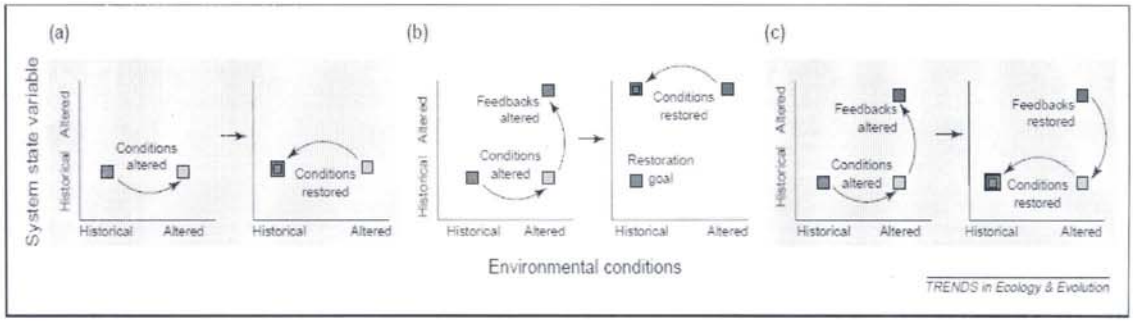

Figure 1. Three alternative restoration scenarios proposed by Suding *et al.* (2004)

For the case of the EMRP, based on recommendation of Euroconsult Mott MacDonald (2008), the area can be restored if mixed tree species that can attract birds and mammals are planted, with the urgent initial step of ecosystem in the area through Hydrological Restoration. However, Euroconsult Mott MacDonald (2008) couldn't define potential alternative recovery states for the area, as they said that it would depend on the current resources, level of degradation, and the type of activities implemented

Moreover, Brearly et al (2004) study in the EMRP area depicted that fifty-five years of succession is clearly insufficient time for the secondary forest to revert to 'primary' forest. On the peatland ecosystem of EMRP, Page et al. (2009) study concluded that re-wetting the peat is an important key to vegetation restoration and protection of remaining peat carbon stocks. Hence, based on the Suding et al (2004) scenarios, the EMRP process and states may follow the scenario (b), where the possibility to be fully recovered to its historical state is very limited.

Social Aspects in the Ecosystem Recovery Processes

McIver and Starr (2001) depicted that there is general agreement that true restoration require not only reestablishment of more desirable structure or composition, but of the processes needed to sustain these for the long term. Recent studies (Chazdon, 2003; Florentine and Westbrooke, 2004, Page *et al.*, 2009) noted that human assistance is required to recover forest structure, species composition, and species interactions typical of mature tropical forests. Moreover, Joosten and Schumann (2007) comparison study of the degraded peatlands in Tibet (China) and Kalimantan (Indonesia) showed that peatland restoration is not only a matter of technical

management, but has an important social dimension. In addition, Page *et al.* (2009) study concluded that restoration must go hand in hand with education, enhanced environmental policies and improved governance to facilitate better stewardship of peatland ecosystem resources.
And for the case of EMRP, in the master plan, it is clearly noted that without local acceptance and support restoration activities is highly likely to fail, this means that local communities need to agree to restoration goals.

CONCLUSION

In conclusion, in reality, the recovery processes and states of degraded ecosystem are varied and is a long term process. Land resources, dynamic and level of degradation are greatly influence the trajectory of the recovery processes and recovery states of the degraded ecosystem. Activities for assisting the recovery processes are site-based and depend on the level of current biodiversity and ecosystem services, state of degradation and amount of time and cost needed. Moreover, tradeoffs between ecological and social aspects need be considered in the ecosystem restoration project, where the tradeoffs may be different in each stage of ecosystem restoration project. In the project planning, ecological aspects are weighted more than the social aspect, while in the project implementation and monitoring, more efforts need to be allocated more in the social aspects that supporting the ecological principles. Thus, in maintaining the long term restoration activities the institutional, budget and the simultaneous mixed type of activities that has long-term goal need to be respected by different stakeholders.

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